BEFORE THE GREATER WELLINGTON REGIONAL COUNCIL AND HUTT CITY COUNCIL

EASTERN BAYS SHARED PATH PROJECT

Under	the Resource Management Act 1991
In the matter	of applications for resource consents by Hutt City Council under section 88 of the Act, to carry out the Eastern Bays Shared Path Project

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STATEMENT OF EVIDENCE OF MICHAEL JAMES ALLIS (COASTAL PROCESSES) ON BEHALF OF THE APPLICANT

30 November 2020

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QUALIFICATIONS AND EXPERIENCE

1. My full name is **Michael James Allis**. I am a coastal engineer at the National Institute of Water and Atmospheric Research ("**NIWA**").

2. My evidence is given on behalf of Hutt City Council ("**HCC**") in relation to its applications under section 88 of the Resource Management Act 1991 ("**RMA**") for resource consents for the Eastern Bays Shared Path Project ("**Project**").

3. I have the following qualifications and experience relevant to the evidence I shall give:

   (a) Degrees of Bachelor of Engineering (Civil) with Honours (2.1) from the University of Canterbury (NZ).

   (b) PhD in Ocean Engineering from the University of New South Wales (UNSW, Australia). My PhD thesis examined the onset, strength and energy dissipation of breaking waves.

   (c) I have 10 years' experience in the coastal, oceanographic and environmental sectors in a range of engineering and research roles, advising on coastal processes, engineering, the impacts of climate change, and coastal hazards. I currently hold the position of Coastal Engineer with the NIWA, by whom I have been employed for the last six years during which I have authored over 40 technical reports and coastal hazards assessments.

   (d) Recent examples of relevant projects I have been involved in include:

      (i) Coastal processes Assessment of Effects on the Environment ("**AEE**") Ngā Ūranga ki Pito-One Shared Path Project (Waka Kotahi);

      (ii) Coastal Processes AEE: Old Mangere Bridge replacement and demolition (Waka Kotahi NZ Transport Agency);

      (iii) Coastal Processes AEE: Northland's Matakohe Bridges replacement (Waka Kotahi);

      (iv) Coastal Processes Assessment: SH1 Ara Tūhono Warkworth to Wellsford (Waka Kotahi);

      (v) Adapting to coastal hazards and climate change (West Coast Regional Council, multiple sites); and

      (vi) Regional storm-tide and wave hazard assessments (Canterbury, BoP, Nelson/Tasman).

4. I am a member of a number of relevant associations including:

(a) Engineering New Zealand (Chartered Member) as a Chartered Professional Engineer (CPEng) in the practice area of Environmental Engineering.

(b) New Zealand Coastal Society (Member and Treasurer).

5. I confirm that I have read the 'Code of Conduct' for expert witnesses contained in the Environment Court Practice Note 2014. My evidence has been prepared in compliance with that Code. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

BACKGROUND AND ROLE

6. In preparing my evidence I have:

(a) visited on several occasions, on foot and by vessel, the area that the Project covers, including nearby beaches of Eastbourne and Petone and the margins of these foreshore areas, to familiarise myself with the setting and coastal processes within the Project area;

(b) attended several technical specialist meetings and workshops (including on 12 May 2017, 22 June -2017, 8 February 2018); and

(c) taken part in a site walkover inspection with other specialists and GWRC coastal specialists (on 25 July 2018).

7. I prepared the technical report *Eastern Bays Shared Path: Coastal Physical Processes Assessment* dated March 2019 ("**Coastal Processes Assessment**") which is included in Appendix E of the AEE.

8. My other roles in the development of the Project to date include the following:

(a) I participated in the multicriteria assessment ("**MCA**") workshops to provide coastal processes input to the consideration of alternatives (see the *Alternatives Assessment* report in Appendix G of the AEE) and design features.

(b) Throughout the earlier design and development stages of the Project, I have reviewed and provided comments from a coastal processes perspective on multiple versions of the Project drawings, Project reports and assessments.

(c) I have worked with the other Project specialists to assist their understanding of coastal processes for their assessments.

(d) I reviewed and provided comments on the Draft Hazard Risk Management Strategy for the Project (as at 28 August 2020).

(e) I have worked alongside the Project specialist team for the duration of this Project, engaging with multiple emails and phone calls throughout 2017 to the present to discuss cross-discipline issues.

9. Other reports or evidence that my evidence draws upon includes the following:

(a) In preparing the Coastal Processes Assessment I reviewed and relied on reports prepared for earlier phases of this Project, reports for other coastal works for HCC, and broader coastal hazard assessments for Te Whanganui a Tara / Wellington Harbour. These are referenced within the Coastal Processes Assessment.

(b) The Beach Nourishment Plan ("**BNP**") for the Project draws on my Coastal Processes Assessment.

(c) I rely on the assessment and draft evidence of **Richard Reinen-Hamill** in the design and specification of the beach nourishment for the Project, and how it informs the BNP.

10. My input to the consideration of alternatives included the following:

(a) Attendance and presentation at several MCA workshops in the early stages of the Project development (2017-2018). These workshops were to evaluate alternative coastal designs where it had been pre-determined that the Project's proposed new shared path ("**Shared Path**") would be constructed on the seaward side of the roadway. The evaluation of alternatives was at a high level to consider and rank the alternatives against key coastal process and engineering principles and climate change impacts, including constructability and lifetime assessment.

(b) One of the key design restrictions which limited the scope of the alternatives assessed was the tie-in elevation to the existing roadway. In this way the Project scope was bounded on the landward side to the elevation and alignment of the northbound carriageway edgeline (the white line).

(c) I prepared a report (dated 28 June 2017) to evaluate potential coastal processes issues for each of the alternatives considered. The report is included in Appendix A of the Coastal Processes Assessment.

(d) I also provided coastal processes and engineering input to the multiple design options throughout the design refinement process and involved multiple conversations and emails with the wider specialist team.

SCOPE OF EVIDENCE

11. The purpose of my evidence is to discuss the effects of the Project on the coastal environment and address how the Project responds to the effects of climate change and sea-level rise.

12. My evidence addresses:

    (a) an overview of the existing environment of the Project area as relevant to my evidence;

    (b) the effects of the Project on coastal processes;

    (c) the effects of climate change, sea-level rise and coastal hazards on the Project and how the Project responds to them, including by increasing resilience and not foreclosing future options;

    (d) steps taken to address potential adverse effects on coastal processes through seawall design and measures to respond to those effects as proposed in the conditions;

    (e) conclusions on effects taking into account the recommended measures; and

    (f) responses to submissions and the section 42A report.

EXECUTIVE SUMMARY

13. Overall, my assessment concludes that the construction and operation of the Shared Path will have a *no more than minor effect* on coastal physical processes provided detailed design and construction elements minimise the specific effects outlined in the Coastal Processes Assessment.

14. Sea-level rise will increase the frequency of inundation and overtopping of the existing structures and coastal flooding on the low-lying foreshore, with increased number of road closures for Marine Drive. The threat is imminent with a 16 cm rise predicted between 2030 to 2040 and up to 0.5 m by 2050. Given the low lying and exposed nature of much of Marine Drive, and the limited height and poor design of many existing structures, high tides already cause issues at some locations and future sea-level rise will further compromise Marine Drive. The effects of sea-level rise are compounded by climate change with increased severity of storm events. Presently some areas of Marine Drive are significantly affected during storm events with wave overtopping causing hazardous driving and walking conditions. But between 2030-2040 the present 1 in 100-year extreme storm tide event is predicted to become a once per year storm tide on average. Storm events increase tidal height and allow larger waves nearer to shore, and are often accompanied by strong winds which create larger waves. The combined

effect results in significantly greater overtopping of the existing structures, coastal inundation (in particular of Marine Drive) and wave action on existing structures.

15. With regards to climate change effects on coastal hazards (ie sea-level rise), the construction of the Shared Path is a first step in a potential series of incremental upgrades that will assist in providing protection to the road (and underground services) in addressing the effects of sea-level rise along this section of the coast.

16. The Project includes design elements that will “buy some time” for HCC to develop a detailed dynamic (flexible) adaptive pathways plan for the Eastern Bays area to adapt to climate change and particularly ongoing sea-level rise over several centuries (along with any region-wide subsidence over this time).

17. The Shared Path has been designed to enable additional protection to be added onto the top of it in the future if that is considered appropriate. It provides a wider foundation platform for any further structural adaptation options, and it does not compromise other realistic future climate change adaptation options for the roadway. However, future community expectations of its “shelf life” will need to be managed, pending a long-term (100-year) adaptation planning and consultation process with the community and utility providers, as outlined in the 2017 Ministry for the Environment’s ("**MfE**") coastal guidance and the NZ Coastal Policy Statement 2010 ("**NZCPS**") .

METHODOLOGY

18. There are no quantitative assessment criteria for assessing the degree of effects on hydrodynamic and sedimentation processes or beach geomorphology. Therefore, my assessment as detailed in the Coastal Processes Assessment relied on specialist appraisal (using a coastal expert and reviewer), supported by desktop research and field observations.

19. My desktop review included readings and/or reviewing:

    (a) previous coastal reports for the Eastern Bays area;

    (b) reports on the broader coastal hazard assessments for Te Whanganui a Tara / Wellington Harbour such as extreme storm-tide and wave studies;

    (c) field measurements (waves, current and sediment properties);

    (d) historic aerial photography;

    (e) news reports on the frequency and severity of wave overtopping along Marine Drive

(f) literature on littoral sediment transport along the Eastern Bays coastline; and

(g) the formation of Point Webb (Eastbourne), inner-harbour seabed sediments, and historic changes to the Eastern Bays beach environment.

20. This also included discussions with local residents about coastal trends and considering observations from representatives on the specialist team (Ginny Horrocks, Derek Wiltshire), long-term residents (John Butt, and Judy and Roger Lawrence), and reviewing the comments from locals incorporated within the consultation (Appendix I of AEE) and recreation (Appendix K of AEE) reports prepared for the Project.

21. The Coastal Processes Assessment used the results of numerical modelling undertaken for the nearby Ngā Ūranga Ki Pito-One Shared Path ("**N2P**", a Waka Kotahi NZ Transport Agency ("**Waka Kotahi**") Project and also part of the Great Harbour Way / Te Ara Tupua shared path encircling Te Whanganui a Tara / Wellington Harbour). This included:

(a) modelling of wave conditions in Te Whanganui a Tara / Wellington Harbour to produce wave climate assessments offshore from each of the Eastern Bays embayments suitable for engineering design; and

(b) modelling of currents and sediment plumes to establish, in a general sense, the fate of fine-sediments that may be discharged to the Harbour.

22. My assessment included considering the analogue of long-term morphological change, as has arisen from the extensive historic changes of widespread seawall construction, and how those changes have contributed to the highly-modified coastal environment of the present-day.

23. My assessment also considered how the coastal environment has responded to the modern 'double curved' seawall designs (I note there is about 310 m of these types of seawalls in place in York Bay and they were installed between 2012 and 2015).

24. My assessment is consistent with key regulatory documents. The Coastal Processes Assessment outlined the regulatory context from a coastal physical processes perspective, while the Appendix S Statutory Assessment contains the full assessment for the Project.

25. The most relevant regulatory documents to this assessment are:

(a) Part 2 of the RMA and the definition of effect;

(b) the NZCPS, specifically

(i) Objective 1 (Safeguard the integrity, form, functioning and resilience of the coastal environment), Policy 10 (Reclamation and de-reclamation, Policy 22 (Sedimentation), Policy 23 (Discharge of contaminants), Policies 24 and 27 (Coastal hazards, climate change and protection of significant existing development);

(ii) of these policies and objectives, key points relating to my assessment are that:

(1) the effects of coastal hazards and climate change were assessed over at least a 100-year timeframe (Policy 24) which is effectively out to 2120; and

(2) that my assessment takes into account national guidance and the best available information – where the national guidance is the MfE (2017) guide (as outlined below);

(c) The Ministry for the Environment Guidance Manual for Coastal Hazards and Climate Change (MfE 2017), specifically the instructions for sea-level rise ("**SLR**") and coastal hazards.

(i) My assessment included several increments of SLR above present-day MSL. They were 0.5 m by 2070 (corresponding to the 50-year design life),1.0 m by 2120 and used 1.35 m by 2120 as the stress-test scenario (NZ RCP 8.5H+[1]).

(ii) I note that my use of a 1.0 m SLR at 2120 is consistent with MfE (2017) guidance which suggests using a transitional SLR allowance for planning purposes where a single value is required at a local or district scale while in transition to developing a dynamic adaptive pathways planning ("**DAPP**") process that needs to be comprehensive across local communities of Eastern Bays, utilities and infrastructure for the longer term (given sea levels will continue rising for several centuries). This is in specific acknowledgement of the part that the Shared Path has within HCC's wider planning response to climate change.

(iii) My assessment also qualitatively considered the secondary effects of climate change (+10% wind speed, wave height and storm-surge out to 2100).

[1] NZ RCP 8.5H+ is the Representative Concentration Pathway scenario 8.5 produced by IPCC and globally used as the 'continuing high emission baseline scenario with no effective global emissions reduction". The MfE (2017) guidance adjusts the global RCP SLR projection with a regional offset for New Zealand. The H+ designation used by MfE (2017) is because it uses the 83rd percentile of the model (as opposed to the 8.5 which uses the median projection). Refer to Section 5.4.1 of MfE(2017) for more information.

EXISTING ENVIRONMENT

Geology and coastal processes

26. The existing coastline along the Eastern Bays is a highly modified and actively managed shoreline. The underpinning geology is of a series of rocky headlands jutting out into Te Whanganui a Tara / Wellington Harbour with sand-and gravel-filled beaches filling the embayments between headlands, but the construction of Marine Drive and other nearby features have modified the natural coastal processes of the area.

27. Beach sediments of the Eastern Bays beaches have arrived from local and distant sources over the Holocene period (12,000 years ago to present), interspersed with sediment pulses from past major earthquakes (ie landsliding, uplift or subsidence). Sediment size of the beaches varies within each embayment and is generally fine to coarse sand. The southern beaches of the Project area are composed of slightly coarser material (more gravel) than the northern beaches (more sand). This trend is related to the proximity of sediment inputs and wave exposure.

28. There is also a thin veneer of coarse sand, gravels and cobbles perched in sheltered pockets on top of the rocky headlands.

29. The tidal range and tidal currents are small within the harbour and most sediment in the coastal zone is transported through wave action, aided at times by wind-generated currents. Waves are relatively small (compared to the open ocean) due to the short inner-harbour distance for waves to develop and oceanic swell waves from Cook Strait are dissipated through the narrow harbour entrance.

30. Historically, in pre-European times, the key source of beach material for these bays was the Hutt River, with minor input from local streams in each bay, from slow erosion of the rocky headlands/outcrops, as well as wave-driven littoral drift from sediment sources beyond the Te Whanganui a Tara / Wellington Harbour mouth.

31. However, human activities have interrupted the sediment supplies (eg Seaview reclamation 1955, Seaview marina breakwaters 1980s, ongoing dredging at Hutt River mouth) hence present-day rates of sediment supply to Eastern Bays beaches are low and not anticipated to increase in the near future.

32. Marine Drive has been widened several times through small seaward enlargements, with the coastal fringe supported by various engineered concrete and rock defences. These structures have encroached onto the upper Coastal Marine Area ("**CMA**") over rock platforms and beaches further limiting local sediment supply (from eroding headlands, dunes) and

interrupted the natural beach sediment processes by isolating the beach face from their former dune and backshore areas (**Figure 1**).

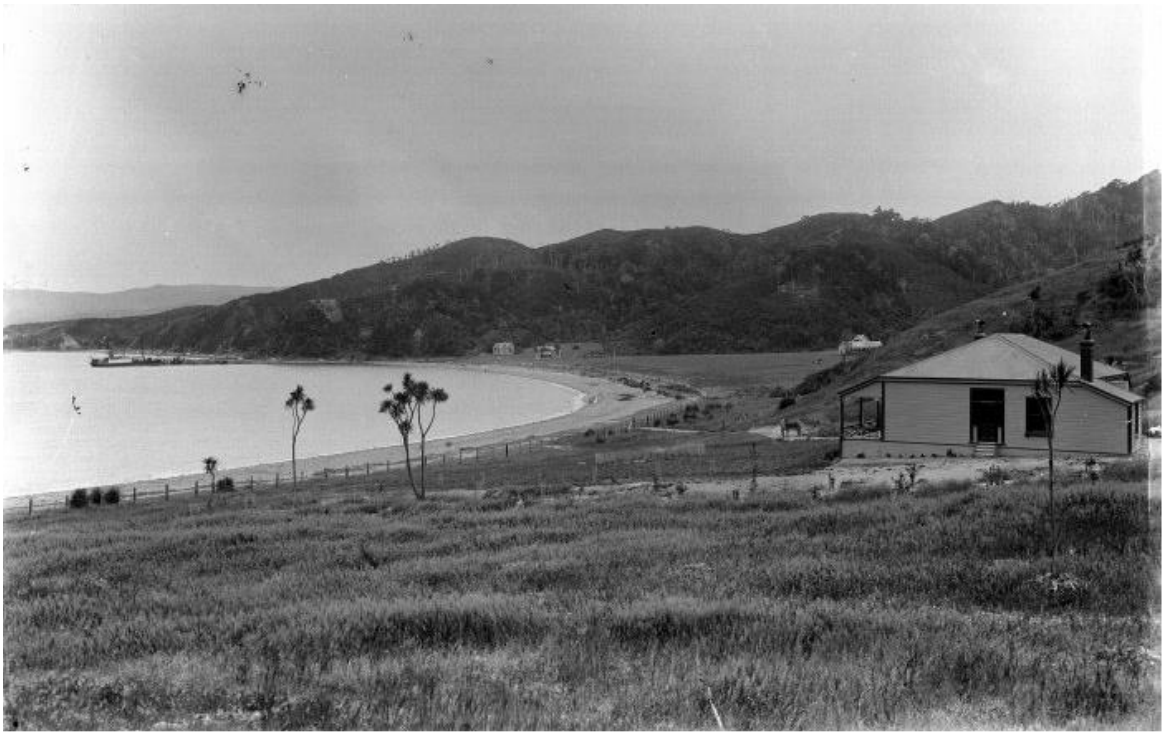


Figure 1 Lowry Bay ca 1890s, viewing North. Note beach with narrow cart track at crest of beach and backed by wide and low backshore in the distance [Source: 1/1-020472-G. Alexander Turnbull Library].

33. The long-term presence of seawalls and coastal structures (eg Whiorau Reserve and boat ramp reclamation) has disrupted the natural sediment transport regime within the bays, particularly during storm events. Over time, the effect of the seawalls and reduced sediment supply (compared to the natural undeveloped state) on the beaches has been the slow loss of sand volume, reducing beach width, coarsening of beach material and changing of the overall plan shape of the beach.

34. The beaches of the Project area show short-term fluctuations of beach width and sediment distribution inside each bay (ie periods of erosion and accretion) on daily to seasonal timescales.

35. There is no clear long-term trend of erosion or accretion in the embayments of the Project area, demonstrating that the sediment volume within each bay remains nearly stable in the long term and the embayments are effectively isolated sediment compartments. Some input of gravel and sand is anticipated to the southern-most beach of the Project (Days Bay and south), but the future volumes are not expected to be substantial due to dwindling upstream supply and reduced wave energy with distance moving north from the harbour mouth.

Marine Drive seawalls

36. Marine Drive is constructed on the low-lying foreshore and is typically less than 3 m above present-day mean sea level (MSL = 0.2 m Wellington Vertical Datum 1953, WVD-53), and less than 2.5 m above the present-day high-tide elevation (0.82 m WVD-53). This low elevation means the road is exposed to hazardous wave overtopping to vehicles/pedestrians during high tides and during storm events. It will be more exposed to these hazards as sea-levels rise with climate change.

37. As the road traverses the rocky headlands it sits on a wave-cut platform which was raised 1-1.5 m in the 1855 Wairarapa Earthquake (see **Figure 2**). Between rocky headlands the road was constructed on the former backbeach areas (see **Figure 1**) with urban development now filling the space between the road and the hillside.

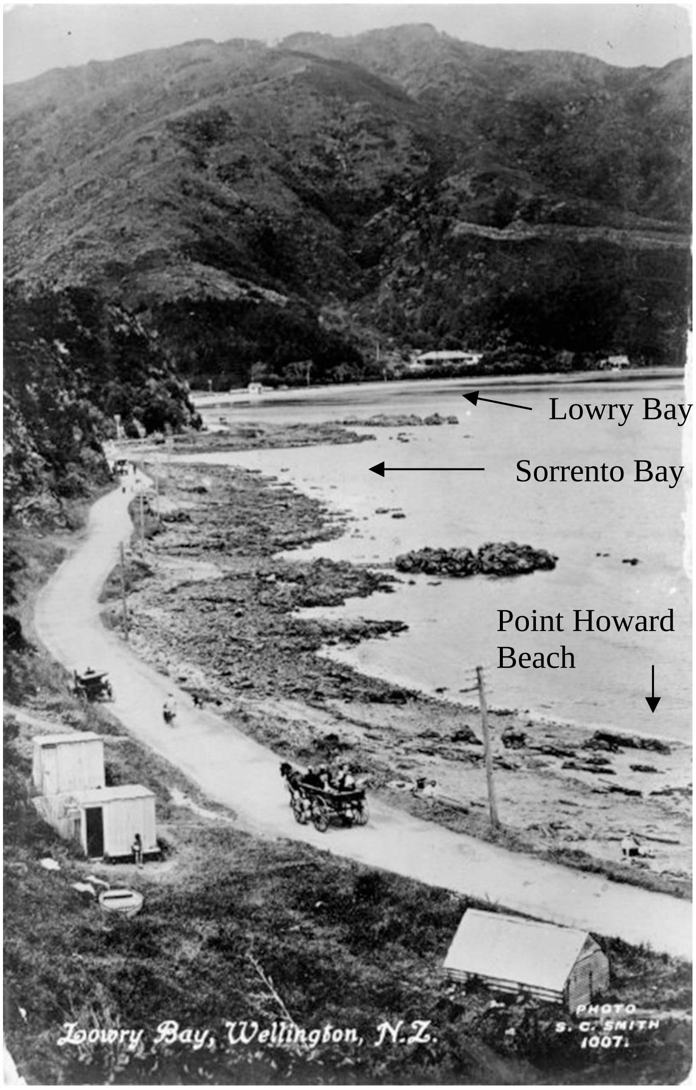


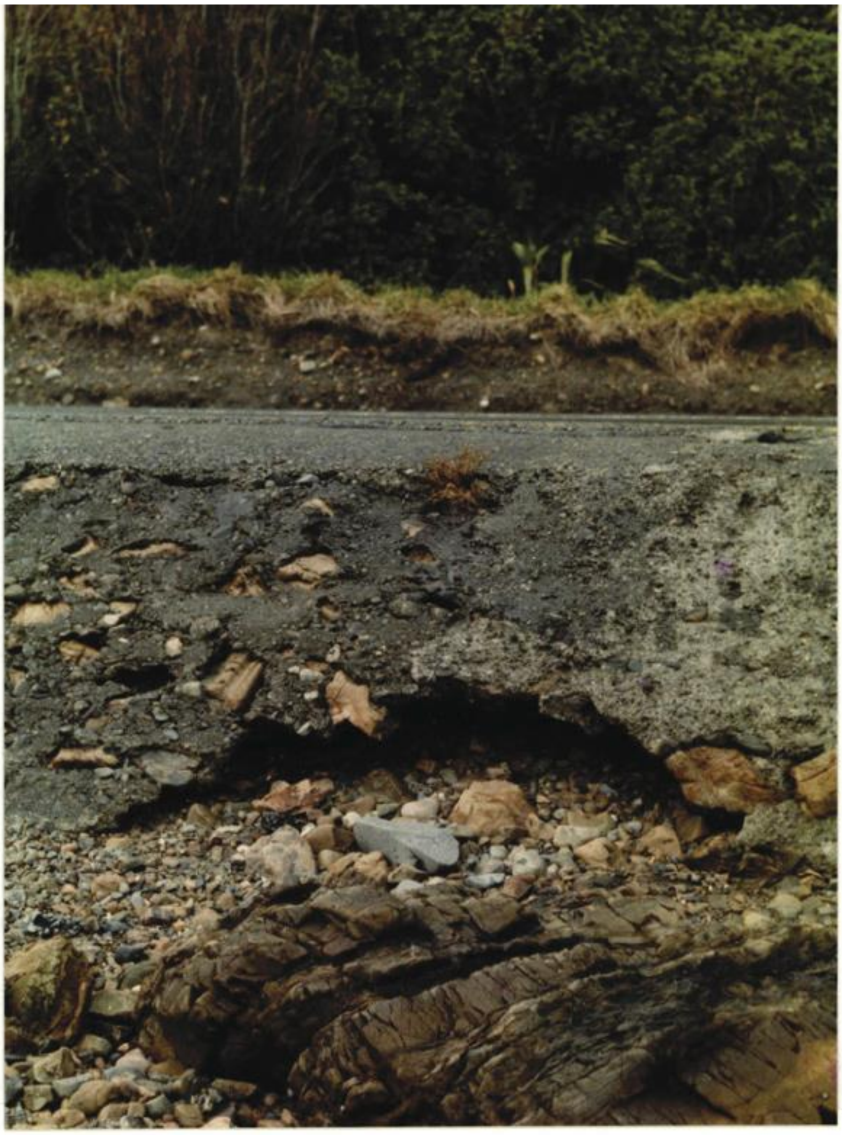
Figure 2 Point Howard Beach, Sorrento Bay and Lowry Bay, ca 1920. View from on Point Howard hillside. Annotations indicate present day beach names. Note broad rocky platforms on which the road is situated, which have since been partly covered by the widened road. [Source: 1/2-030788-F Alexander Turnbull Library. Photographer: Sydney Smith].

38. The roadway has been widened several times through small seaward reclamations over the last century. The coastal fringe is currently supported by at least 10 different types of engineered concrete, rock or timber structures (ie seawalls, revetments, boardwalks) several of which are in poor condition, suffer from undermining[2] and provide inadequate protection to vehicle/pedestrians during storm events.

Figure 3: Erosion and undermining erosion of wire and stone wall at northern end of Lowry Bay (Jan 1991). [Source: HCC archives].

[2] Erosion and washing away of foundation material beneath the concrete seawall by wave action flushing out supporting material.

Figure 4: Erosion and undermining of seawalls repaired with concrete along rock platform between Pt Howard Bay and Sorrento Bay (May 2017). [Source: M. Allis (NIWA)].



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Further seawall erosion, York Bay.

Some of these holes can extend into "caverns" under the road.

Figure 5: Undermining of concrete patch to seawall in York Bay (Jan 1991). [Source: HCC Archives – original caption included].

39. Erosion of the seawalls and foundation beneath Marine Drive is a longstanding issue (**Figure 3, Figure 4, Figure 5**), to which there have been many repairs resulting in the patchwork of seawall designs, ages and conditions as seen in the highly-modified environment that exists today. It is vulnerable to failure and does not provide consistent, nor effective, storm mitigation with roughly a third of the existing seawall having less than 15 years of life remaining (some areas have considerably shorter).

Wave overtopping hazards

40. The low-lying Marine Drive and urban areas within the Eastern Bays are well known as areas that will experience flooding and road closures during high water levels combined with waves and onshore winds. At times wave overtopping makes Marine Drive unsafe for vehicles and pedestrians in several locations (**Figure 6** and **Figure 7**).

Figure 6: Wave overtopping at Mahina Bay (22 June 2013)[3]

[3] Source: https://talltalestravelblog.files.wordpress.com/2013/06/photo-22-06-13-16-15-31.jpg

Figure 7: Wave overtopping at central Lowry Bay (22 July 2017)[4]

Climate change effects on existing environment

41. Ongoing climate change will unavoidably affect the existing environment primarily through rising sea levels. Rising sea levels will increase the frequency and severity of coastal hazards and road closures along Marine Drive, as well as reducing beach areas (as no sediment supply increase is expected).

42. Beach size reduction of 50% less than present day is anticipated once SLR reaches 0.5 m (2050s) and possibly sooner if the current secular subsidence of 2–5 mm/year continues.

43. Sea-level rise will increase the frequency of inundation and overtopping of the existing structures and coastal flooding on the low-lying foreshore, with increased number of road closures for Marine Drive. The threat is imminent with a 16 cm rise predicted between 2030 to 2040 and up to 0.5 m by 2050. Given the low lying and exposed nature of much of Marine Drive, and the limited height and poor design of many existing structures, high tides already cause issues at some locations and future sea-level rise - will further compromise Marine Drive. The effects of sea-level rise are compounded by climate change with increased severity of storm events. Presently some areas of Marine Drive are significantly affected during storm events with wave overtopping causing hazardous driving and walking conditions. But between 2030-2040 the present 1 in 100-year extreme storm tide event is predicted to become a once per year storm tide on average. Storm events

[4] Source: https://www.stuff.co.nz/dominion-post/news/wellington/95013382/waves-crash-over-cars-as-storm-hits-lower-north-island

increase tidal height and allow larger waves nearer to shore, and are often accompanied by strong winds which create larger waves. The combined effects result in significantly greater overtopping, inundation and wave effects.

44. More detailed descriptions of the existing environment are included in Section 4 of the Coastal Processes Assessment.

EFFECTS OF THE PROJECT

45. My assessment of operational and construction effects includes both the effects *of the* Project on the environment (such as beach erosion) and effects of the environment *on the* Project (such as extreme waves or climate change), which ultimately address public safety effects and management of significant risks (in accordance with RMA; s6(h)). This assessment is primarily documented at the wider scale across the Eastern Bays Project area but supplemented on a bay-by-bay basis, as necessary, to highlight significant site-specific differences or effects.

46. The key concept to understand, when considering the potential effects of the Project on coastal physical processes, is the scale of change and type of change to the existing seawalls. No new areas of seawall are proposed and all are effectively modifications and upgrades of the existing seawalls. This concept of small, incremental change translates into most aspects of my assessment, and the degree of effects anticipated.

Encroachment into the CMA and the Coastal Zone

47. In essence, the Project proposes only small changes to the coastal environment via a narrow encroachment into the CMA and the local Coastal Zone (which I have defined as the crest of the existing seawall down out to 200 m offshore, approximately to the 5 m depth contour – where coastal sediment exchange takes place under wave action). The overall shape of this encroachment is a thin sliver alongside Marine Drive with 1.23 m average encroachment over the 4.4 km project length. This total encroachment area is small (0.7%) compared to the total Eastern Bays coastal zone area (88 ha) and has a *negligible* to *no more than minor* effect (on the relevant area that coastal processes may be able to take place within) relative to the total area of the Eastern Bays coastal zone.

48. Note that this area does not include an assessment of the loss of the area of beach available as a public amenity, nor the beach nourishment itself which I consider is excluded on the basis that the deposition is for the purpose of managing or improving the amenity value of the foreshore (in line with Proposed Natural Resource Plan (Decisions Version) ("**PNRP**") R207(c-e) and matters of control PNRP R207(1-7)). The beach amenity and nourishment design are addressed in the evidence of **Julia Williams**

(landscape and visual amenity), **Rob Greenaway** (recreation) and **Mr Reinen-Hamill** (beach nourishment).

Seawall and revetment designs and effect on hydrodynamics and sediment transport

49. Two types of coastal defences are proposed; a concrete seawall and a rock revetment. The revetment is proposed for rocky shore areas (approximately 430 m) where it is desirable (from a geology and coastal defence perspective) to maintain a non-concrete shoreline and in areas of existing rock revetment. The concrete seawall is proposed in areas of existing seawalls (approximately 2.65 km). For further design information see the *Design Features Report* in Appendix J of the AEE and the evidence of **Jamie Povall** (Project design).

Seawalls

50. The new seawalls take the form of a curved stepped design which is keyed into bedrock (**Figure 8**). One, two or three curved steps are proposed depending on the height of the road above the foreshore. This design replaces the patchwork of existing seawalls with a more modern design, with better wave-dissipating capability (reducing, but not eliminating, wave overtopping and reflections – as discussed below) and improved resilience to undermining erosion.

51. The proposed seawalls are relatively steep and stepped in an effort to balance the need for wave dissipation (best achieved through a flatter slope or a revetment) and to minimise encroachment onto the beaches.

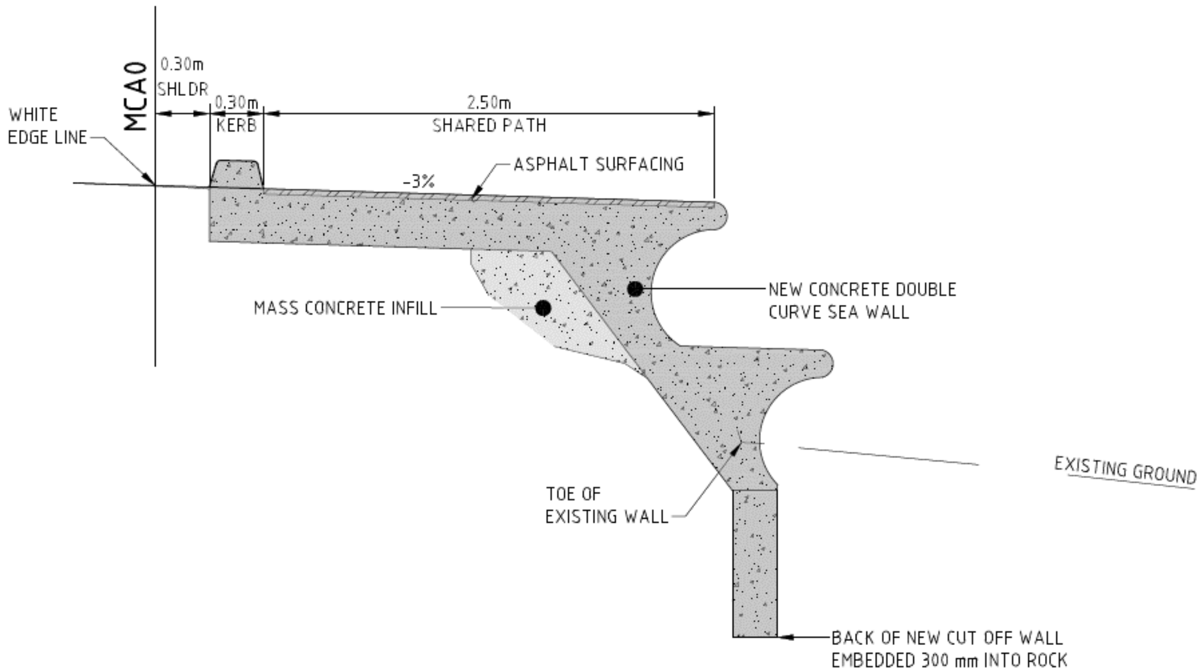

Figure 8: Double curved concrete seawall, variants include single and triple curves.

Revetment

52. The revetment is proposed for rocky shore areas as per **Figure 9**. The concrete cantilever wall behind the rock amour is to be designed as a standalone element meaning the path and wall do not rely on the rock material to retain them. The preliminary design of the revetment profile is consistent with Coastal Engineering Manual (USACE, 2006) to optimise structural stability and minimise wave overtopping. The final design of the revetment areas will be addressed during detailed design, including secondary design aspects of rock sizing grading curve, rock strength requirements, and any placement requirements (eg filter/bedding layer specifications). For further design information see the Coastal Processes Assessment.

53. I note that the local greywacke quarries (eg Horokiwi) produce material suitable for bulk concrete aggregates, but the quarry material fractured (due to the seismicity of Wellington) and this makes it difficult to obtain sufficient volumes of rock sufficient strength/durability/quality. I anticipate that the Project will need to import higher quality volcanic rock material than has been required for other coastal rock revetments in Wellington (this may include andesite from Taranaki or dolomite from Golden Bay). The rock specifications will be undertaken during detailed design with the contractor to determine a suitable source.

54. These rocky revetment structures are only proposed in areas where there is an existing rocky foreshore or revetment, or the area is susceptible to larger waves with overtopping a concerning issue for pedestrians and traffic (ie in northern Lowry Bay).

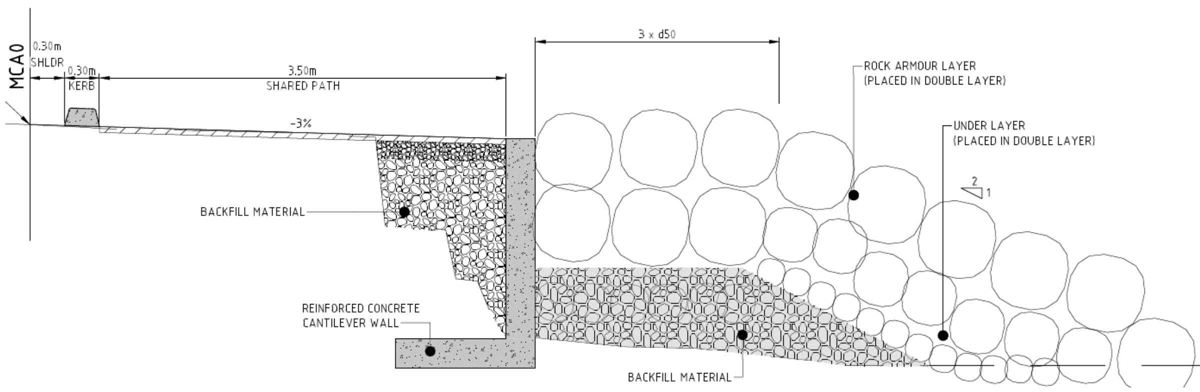

Figure 9: Revetment with reinforced concrete cantilever wall. Note a geotextile underlay (not shown) will be included between backfill and underlayer.

Hydrodynamics

55. Overall, the proposed seawalls and revetments will only cause a *minor* change to the nearshore wave processes (such as wave reflections and wave driven currents) and the coupled effect on nearshore sediment

processes which could lead to localised small-scale erosion or accumulation of beach sediment. As occurs now, the beach material will come and go with cycles of storms and seasonal wind and wave changes. Support for my conclusion of minor changes is found in how the beaches and rocky platforms have responded to the recently constructed double curved wall sections in York Bay (**Figure 10**). Further, the seawall designs are generally expected to reduce wave reflections (compared to present day), which take sediment away from the beach face.

Figure 10: Recently constructed double curved seawall at southern York Bay with sediment accumulation and hence transport in the coastal zone at the foot of the seawalls.

56. I expect that small local accumulations of sand or driftwood debris will still occur due to the natural wind/wave-driven surface currents (as pictured in **Figure 10**). This accumulation of sand/debris is a short-term process, depending on the wind conditions at the time, and is *negligible* in relation to bay-wide longshore sediment transport.

57. The alignment of the proposed seawalls is sub-parallel to the existing seawalls without any abrupt changes, gaps or discontinuities where edge effects could cause localised erosion or accumulations. The features which do interrupt the smooth alignment of the proposed seawalls (such as the necessary proposed beach accessway steps and the transition between wall types or to rocky foreshore) have been designed to ‘taper' the changes over a length of shoreline to reduce potential interruption to sediment transport along the beaches.

58. Areas with small wave exposure, such as on the lee-side of rocky headlands, have a transitional design of overlapping revetment and seawall extends across a 0-5 m length. At the most wave exposed locations, where transitioning between rock revetment and double curve walls areas (eg northern Lowry Bay), the transitional taper has been lengthened to 20–40m.

59. Regarding beach accessways, the position within each bay, orientation and type of beach access location are important to prevent obstruction of longshore sediment movement. With appropriate consideration of coastal processes, the effect has been mitigated to be *no more than minor*. The Preliminary Design Plans include beach accesses which are narrow and parallel to the shoreline, and generally positioned at the northern or southern extremities of the beaches (at the change to natural rock outcrops) or integrated with wall type transitions.

60. Overall, the measures included in the design to minimise the encroachment and the effects will ensure the Project has a *no more than minor* effect on coastal processes.

Beach nourishment

61. Beach nourishment is addressed in full within the evidence of **Mr Reinen-Hamill** and his *Beach Nourishment Assessment* (Appendix F of the AEE).

62. Overall, I agree with **Mr Reinen-Hamill's** approach to the design of the beach nourishment. With the actions he proposes the potential effects are *low* (and less than minor) over the lifetime of the Project, and the placed sediment will behave similarly to the existing beaches with the same wind, wave, and tide regime, albeit in a newer, more seaward, position.

63. I also note that in addition to maintaining beach amenity (both landscape and natural character, and recreation), the nourishment provides several related minor benefits which will benefit the Shared Path and Marine Drive as sea-level rises via a slightly larger erosion buffer, such as: a one-off sediment supply reinstatement (off setting historic losses); increasing the overall sediment volume; and coarseness and longevity of beach sands.

Wave overtopping hazards

64. As mentioned above a key coastal engineering constraint of the Project is that the proposed pathway has a smooth transition from the existing road surface to the Shared Path surface (ie no kerb channel for stormwater interception). This effectively constrains the elevation of the pathway to that of the existing road (at white edge line), minus some cross-fall allowance for stormwater drainage over the Shared Path. The Alternatives Assessment provides the assessment and rationale for this design limitation. However, I note that without a change to the elevation, the Shared Path and road will still be subject to wave overtopping and splashing during storm events, and

increasingly so as sea-level rises. The design will not ‘solve’ the wave hazard issue for the community but rather, as above, they are proposed as a measure to "buy some time".

65. However, the proposed seawall replacements are expected to reduce the overtopping hazard (compared to present day) during minor to moderate storm events along all sections of the Eastern Bays covered by the Project. This improvement is through new structures that provide more effective deflection, dissipation and reflection of incident waves than the existing seawalls. This is only a *minor positive* effect as there will be little change to the overtopping hazard during large storms at high tides, and there will be no change in crest elevation of the seawalls even though the new crest is 1-2m seaward from the present crest. This is a key constraint on the effectiveness of the coastal protection.

66. There is also a *minor improvement* because wind-driven spray and debris/sediment will unavoidably cause nuisance flooding across the roadway during storms (but less often for small-to-moderate storms), and temporary closure of the Shared Path and reduction in speed on Marine Drive may still be required.

67. Several sections of coastline (eg the northern 200 m of Lowry Bay) are more susceptible to wave overtopping and road closures due to their exposure to larger waves, wind direction and deeper water near to the shoreline. The present design is more robust in this location and will, more effectively, reduce the overtopping. However, for larger storm events there is unlikely to be any change to the overtopping hazard as the unaltered wave heights and relative freeboard (elevation difference from MSL to the top of the structure) governs the overtopping discharge rates. Detailed design at each section will consider further design improvements to minimise overtopping where possible.

68. The reduction to the overtopping hazard is only a short-term relief, as the effect of rising sea-level will be to gradually increase the frequency of overtopping. Hence, the proposed works will only ‘turn back the clock’ for a short period of time (depending on the actual rate of SLR).

Climate change and coastal hazards

69. Irrespective of the effects of the Project, the principal effect of a rising relative sea level (including ongoing subsidence trend) on the low-lying Marine Drive foreshore is an increase in frequency of wave overtopping and coastal inundation.

70. The effect of storms will be more apparent over time as, for example, with only 30 cm of SLR the frequency of the present day “100-year storm” for coastal flooding in Wellington will have increased to once per year on

average between 2030-2040 (refer to NIWA 2015, PCE 2015 in Appendix E of AEE). Given sections of the road are presently flooded a few times per year, this progression in hazard frequency clearly demonstrates that the present coastal road will have an increasingly marginal level of service into the future

71. The proposed new coastal defence will perform better (ie reduced overtopping) under storm conditions than the existing profile. However, the effect of ongoing SLR means that any improvement to the level of service (with respect to wave overtopping hazard) along Marine Drive will only be short-term, as the rising sea level (and land subsidence[5]) will continue to reduce the level of protection provided and increase the number of road closures.

72. Essentially, the improvements to the seawall design, the seaward extension for the Shared Path, and beach nourishment only delay the inevitable, or "buy some time" in terms of impacts on Marine Drive. In the time gained, HCC need to consider long-term options for managing the road access to Eastbourne, specifically allowing for adaptation to ongoing SLR, which will continue for several centuries.

73. The proposed beach nourishment also has a *minor benefit* to delaying the negative effects of SLR on beach areas (ie the beach will last slightly longer than without nourishment) principally because the imported nourishment only recreates the present-day beach rather than intentionally increasing it. However, through recreating the beach the volume of each beach increases providing a small increase in material for each beach to respond to rising sea-levels. Further, the imported sediment will be slightly coarser than existing and not lost offshore as quickly so it will endure within each bay for longer and provide a larger buffer than the existing beach alone.

Adaptively managing the effect of climate change

74. The Project includes design elements which meet the DAPP principles of iterative long-term management of uncertain SLR trends (which will continue for centuries) as outlined in the MfE coastal guidance (MfE, 2017).

75. The Shared Path has been designed to enable additional protection to be added onto the top of it in the future, if that is considered appropriate. It provides a platform for any further structural adaptation options (say, by adding another layer of the curved revetment) and it does not compromise other realistic future climate change adaptation options.

76. However, future community expectations of its "shelf life" will need to be managed, pending a long-term adaptation planning and consultation process

[5] Excluding future earthquake rupturing

with the community and utility providers, as outlined in the 2017 MfE coastal guidance.

77. The Project itself does not provide full protection against storm events now or into the future. The Project does, however, increase the resilience and functionality compared to the existing seawalls and provides a design that can be adapted in future. In doing so, it "buys time" for long-term solutions to be considered and, if required, provides a foundation on which additional resilience measures can be constructed in the future if HCC decides, after a thorough investigation and consultation strategy for the long-term future of the road, that future structural upgrades of coastal defences are required.

78. I understand that HCC are embarking on a project to develop long-term planning pathways to adapt infrastructure and communities to climate change, as well as enabling more structural adaptation options to utilise the improved foundations. The Eastern Bays Shared Path forms the first step in this journey.

Cumulative effects

79. There are no cumulative effects of known external projects in the environs of Te Whanganui a Tara / Wellington Harbour or south Wellington coast which, when combined with the Project, will have a combined adverse effect on coastal physical processes of Eastern Bays that is *more than minor*. The effects of the external projects are generally local to that project with *negligible* effects which could overlap with effects from this Project, and I consider that any resultant cumulative effect will also be *negligible*.

Construction phases

80. My assessment of construction-phase activities and works details the effects of the Project on the coastal environment. This assessment is primarily documented at the wider scale across the Eastern Bays Project area but supplemented on a bay-by-bay basis as necessary to highlight significant site-specific differences or effects during construction. The assessment addresses the *additional* effects from the construction of the Project.

81. I note that the detailed construction methodology will be finalised on appointment of a contractor in accordance with the conditions of consent.

82. The curved concrete walls are anticipated to follow a similar construction methodology to the curved walls built in York Bay (between 2012 and 2015).

83. A construction methodology for other key elements of the Project is yet to be fully developed, including the rock revetment, access paths, transitions between wall types and tie-ins to natural rocks. I understood that these will follow the same principles as the *Design Features Report* and as detailed in the Construction Environmental Management Plan ("**CEMP**").

84. The key principles of the proposed construction method which minimise the potential effects on coastal processes are as follows:

(a) The construction is proposed to be phased with only 20-40 m under construction at any time and involves a small additional encroachment into the CMA. This reduces the duration of temporary construction features (bunds, walls) and the time that a construction site may potentially be overwhelmed by storm conditions.

(b) Excavation for seawall foundations will generally be shallow (<1 m, see **Figure 8** for the majority of the Project with simple mechanical excavation required.

(c) Areas of deeper excavation will utilise traditional deep foundation techniques such as reinforced concrete cut-off walls, sheet-piling, or bored or driven reinforced concrete piles as required, depending on depth and loading on the foundation. Details will be provided in the CEMP for the specific sections of seawall.

(d) Excavated beach material is to be stockpiled nearby and replaced on the beach after construction of each section of wall as appropriate. This will only relate to suitable natural weathered material and any non-native material that will be removed to landfill.

(e) Construction of the concrete components of the seawalls will be undertaken on site (not precast) with the curves to be constructed using prefabricated formwork, and walls to be formed in 'lifts' to aid construction and minimise time in the intertidal zone. This method of construction has also been proven to work well during the construction of the previously constructed York Bay section (**Figure 11**).

Figure 11: Example of in situ construction methodology at York Bay.

(f) The indicative construction programme suggests construction is staged on a bay-by-bay basis, with each bay completed in its entirety over a 3-6-month period. Therefore, there will be no new and old sections of seawall adjacent to one another exposed for a long duration or for a winter-storm season. The risk of premature damage from waves deflected from the new wall onto to the old and failure of older, and weaker, seawalls is minimal.

85. The temporary loss of CMA and coastal zone area by construction formwork/staging or bunds is unavoidable to prevent the potential discharge of fine-sediment materials or cementicious products into the CMA. Overall, the effects are *negligible* from the relatively small and temporary loss of coastal area within the 20-40 m under construction at any time.

86. The small scale of the temporary encroachment means the potential coastal processes effects (erosion scour, accumulation) are similarly localised and temporary while each 20-40 m section is under construction.

87. The main risk to the intertidal environment during the construction phase is potential sediment-related effects as well as the accidental release of water contaminated with cementitious products. This is discussed in the evidence of **Shelley McMurtrie.** A site plan for removal of temporary sediment ingress would be developed and the disposal of any dewatering products. All water from the excavations will be treated for sediment and cementitious products before being discharged either to the CMA or through the stormwater system. These details will be addressed in the CEMP for the specific sections of seawall.

88. Site management will also need to monitor weather conditions and forecasts to anticipate any weather, wave and high tide events that may lead to high seas and plan mitigation measures to enclose or protect the worksite accordingly.

89. I note that the construction programme may be up to six years long, and hence there is a risk that maintenance of the existing seawalls could cease because of the pending upgrades anticipated from the Project. This is a minor risk to the environment, and easily minimised by ensuring continuation of the periodic condition assessments by HCC, and can be readily addressed with construction machinery and materials available within the Bays to use if required.

90. Beach nourishment construction is addressed in full within the evidence of **Mr Reinen-Hamill** and his *Beach Nourishment Assessment* referred to above.

91. Overall, I agree with **Mr Reinen-Hamill's** approach to the design and placement of the beach nourishment, and with these proposed actions the potential effects during construction are low (less than minor) over the lifetime of the Project, and the placed sediment will behave similarly to the existing beaches with the same wind, wave, and tide regime, albeit in a newer, more seaward, position.

Steps taken to address potential adverse effects

92. I have been involved with the design process and have seen that measures necessary to minimise potential adverse effects have been included, or can be adaptively managed via monitoring. I am comfortable that the proposed conditions sufficiently address the potential adverse effects of the Project such that that the overall effects on coastal physical processes will be no more than minor.

93. I have proposed recommendations for the detailed design phase of the Project as well as coastal monitoring that will be required both during construction and the first few years of operation. The monitoring (**EM15**, **EM17**) during construction is to ensure work is undertaken in a way that avoids, remedies or mitigates potential adverse effects during the construction period, while monitoring post construction is proposed to confirm the behaviour of the nearshore environment in response to the Project.

94. The key monitoring recommendation incorporated into the proposed conditions of consent is that HCC develop a BNP which includes undertaking monitoring of beach volume via six-monthly beach profiles (or equivalent elevation surveying techniques) for two years, with periodic expert assessment of results as set out in proposed condition **EM15** and **EM17**. This is to ensure that the actual effect on beach sediment processes is in line with the expectations for generally minor redistribution of beach material with

minor changes to beach volume and beach area compared to the present day. I acknowledge that my Assessment initially recommended five years of monitoring; I recognise that **Mr Reinen-Hamill** completed his *Beach Nourishment Assessment* after my Coastal Processes Assessment and recommended two years, which I agree with on the basis that further monitoring can occur on the recommendation of a suitably qualified scientist. The proposed conditions of consent reflect this and, where it is deemed necessary, monitoring will total a five-year monitoring period.

95. Other consent conditions have been suggested to document physical changes to the existing environment and to ensure best-practice construction techniques and post-construction record-keeping. These are to be addressed in the CEMP and BNP and within detailed design.

96. In the unlikely event that the assessments indicate that unanticipated erosion is occurring (ie beach in disequilibrium), the beach nourishment consent will still be active (and other bays may still be under construction) and HCC may be able to easily top-up the beach with more fill to compensate for erosion losses.

CONCLUSIONS ON EFFECTS

97. Overall, my assessment determines that the construction and operation of the Shared Path will have a *no more than a minor* effect on coastal physical processes – provided detailed design and construction elements mitigate the specific effects as per the design plans and proposed conditions of consent.

98. Regarding climate change effects on coastal processes (ie coastal hazards and SLR), the Shared Path is a first step in potential incremental upgrades that will assist in providing protection to the road (and underground services) in addressing the effects of SLR along this section of the coast.

99. The Project includes design elements that will “buy some time” for HCC to develop a detailed dynamic (flexible) adaptive pathways plan for the Eastern Bays area to adapt to climate change and particularly ongoing SLR over several centuries (along with any region-wide subsidence over this time).

100. Future community expectations of its “shelf life” will need to be managed by HCC, pending a long-term adaptation planning and consultation process with the community and utility providers.

RESPONSE TO SUBMISSIONS

101. I have reviewed the submissions that I believe relate to coastal processes and the proposed beach nourishment and wish to provide some comment and response to the submissions from), John Butt (63), Janet Hay (73), East Harbour Environmental Association Incorporated (80), Janice Heine (128), Harold Knight (132), Dr Lawrence (177) and Mr Rashbrooke (179), Harvey

Calder (200), the Royal Forest and Bird (170), East Harbour Environmental Association Incorporated (80)

John Butt. (63)

102. Mr Butt suggests that the design should have a 200 mm height separation from the road for safety purposes and that raising the height 200 mm would be useful in relation to SLR. I agree that this would have a slight benefit for resilience to coastal hazards and SLR. However, it would also complicate stormwater/overtopping water disposal along the route, with water no-longer being able to flow straight across the path and back into the sea, requiring collection and conveyance via culverts which may be prone to blockages with the volume of water and debris, which will also increase with SLR. This issue was highlighted during initial discussions about the seawall design with the rationale underpinning the height limitation contained in the *Alternatives Assessment* (Appendix G to the AEE).

103. Mr Butt also suggests a larger scale beach nourishment than proposed by dredging material from the harbour seabed. I note that this submission has been addressed by **Mr Reinen-Hamill** in his evidence and I concur with his evidence.

Janet Hay (73)

104. Mrs Hay suggests that creating a 2m wide boardwalk as an interim solution will allow for continuity of the pathway in areas when it becomes too narrow for cyclists and pedestrians to use it safely. She indicates that the 10-15 year life span of such a boardwalk structure would also buy some time for a long-term SLR and climate change strategy to be considered. The rationale behind this suggestion is similar to that of the Project, but with several key differences (detailed below) which led to a boardwalk structure being discarded during the MCA process and *Alternatives Assessment* because it was considered:

    (a) inappropriate for the natural character of the area;

    (b) not to provide much protection from coastal hazards;

    (c) more vulnerable to damage than the concrete and rock designs proposed;

    (d) to have a shorter design life and require replacement/repair after 15 years (which is much shorter than the 50-years (or longer) that the concrete and rock design will last).

    (e) to have no useful material left, after the 15-years, to build any future coastal defences on, thus making the design a single cost (with interruption to traffic) with no long-term benefits – unlike the proposed designs.

105. I agree that HCC need to begin the formation of a quality long-term solution and the time that the Project provides should be used to develop this plan.

East Harbour Environmental Association Incorporated ("EHEA") (80)

106. The EHEA suggests that scouring of the beach sand and gravel in York Bay is expected to occur as a result of the construction of the path and its proposed form. It was noted this could lead to 'complete destruction' if it continued, and they oppose the use of double and triple curves in the form of the wall along beaches due to scouring. The EHEA note that scouring is already apparent in York Bay where the walls have been constructed.

107. York Bay is a location where the roadway is particularly pinched between the steep hillside and the harbour. There is little room to provide a Shared Path of any width. The alternative design is to create rock revetment (as is proposed at the headlands and as exists at southern Sunshine Bay) which will encroach much further onto the beach than the seawalls. I note that the 'new' existing seawalls are positioned above rocky platforms (in the south of York Bay), and show continued sediment transport (accumulation and loss) across the intertidal areas as can be expected to continue at York Bay.

108. I disagree with the assertion that the new seawalls will cause further erosion and loss of beach area. I note that the older curved types of seawall throughout York Bay are the result of designs that exacerbate wave overtopping and beach lowering due to their planar slope which 'ramps' waves and debris up onto the road, and accelerates backwash drawing material away from the beach face. The newer double curved revetments instead 'flip' the incoming smaller waves, dissipating wave energy more effectively, and hence will reduce scour and erosion compared to the existing seawalls.

109. The EHEA also notes that the seawalls will not be able to be used as back rests which will limit enjoyment. I appreciate the EHEA's point but consider that the amenity of a seawall needs to be balanced with their function of protecting landside assets. For example, the existing planar seawalls of York bay are nice to recline against, however they increase wave overtopping and beach erosion (as discussed below).

East Harbour Environmental Association Incorporated (80), Harvey Calder (200) and Janice Heine (128), Sally Bain (158), Richmond Atkinson (168)

110. The EHEA, Mr Calder, Mrs Heine and Mrs Bain suggest that rip-rap rock islands, 'breakwalls', surf breaks or breakwaters and other artificial structures could be constructed offshore from the beaches as an alternative structure to absorb the power of waves instead of the proposed design.

111. I agree that these types of artificial structures can be effective methods of dissipating wave energy and promoting a build-up of beach material at the coast – with appropriate balancing of the benefits and effects of such structures. However, in relation to the Project, construction of such offshore features would:

(a) occupy a larger area of the CMA;

(b) not remove the need for a new seawall because there is no space within the existing road corridor for the Shared Path;

(c) would do very little to provide resilience for Marine Drive against SLR as these structures are primarily used to counter wave activity - and it is SLR which is the main driver of the future risk to the roadway.

112. I also note that GWRC responded to this matter raised by submitters within Section 5.2.1 of the Letter Dr Dawe to GWRC (31-Jan-2020) which supports the above response about the suitability of offshore structures to the Eastern Bays region.

113. I am also the coastal processes specialist for the consent application of the Ngā Ūranga Ki Pito-One Shared Path Project which has been raised. The offshore habitat islands used in that project are specifically for bird roosting purposes, are only 10 m^2 and are positioned at least 40 m offshore. Their locations have been selected as to not to interfere with wave and sediment transport processes on the shoreline. Along the Eastern Bays foreshore an offshore structure would need to be very differently designed (for example, significantly larger and located closer to the shore) to have the benefits desired for beach material retention.

114. Offshore breakwaters/islands could be considered in the future as part of a broader adapting to climate change strategy with full consideration of costs and benefits, landscape and visual character, and environmental impacts.

Harold Knight (132)

115. Mr Knight provides photos as evidence that some portions of the road are shaped poorly and do not allow for drainage in the event of sea inundation, especially at Lowry Bay. I agree with the assertion that the existing concrete seawall shape at northern Lowry Bay exacerbates the wave overtopping in this location.

116. Mr Knight suggests that the implementation of a higher barrier to prevent the sea from splashing onto the road would be more beneficial. He provides an indicative sketch of a higher crest and a single large curved structure. These types of designs can be appropriate in the right situation, however, the design for the Eastern Bays must consider a balance of effects and benefits. Some of the complications considered for the Eastern Bays path were

drainage of stormwater and overtopping water, strong opposition to a high visual barrier which cuts people's views from within residences and vehicles, encroachment onto the Shared Path (for the upstand) or further into the CMA to allow for the loss of Shared Path space. I also note that the design includes provision for another level to be added to the edge of the seawall, and, should the proposed design not perform as required in the key locations, this may be implemented in the future.

117. I agree that the seawalls will have little effect against large storms and waves, and note that the main defence against this effect is increasing the elevation, or pushing seaward with a revetment – both of which were considered in the alternatives and did not proceed. I believe the resulting design is an appropriate balance of function, form and effects for its setting.

Judy Lawrence (177)

118. Dr Lawrence provides her observations of the changes to Point Howard Beach over the last 40 years and the gradual change to the beach area through coastal encroachment and sediment losses. She is concerned that the proposed beach nourishment is done solely to offset the encroachment of the beach as it exists today and does not provide a long-term solution. Dr Lawrence recommends that the monitoring condition be modified to include a review after the two year monitoring period to determine whether monitoring should continue and to link it to the longer term adaptive pathways that will need to be considered to manage the effects of climate change.

119. I agree with Dr Lawrence that the proposed design is to minimise the encroachment of the beach of the proposed seawall and Shared Path and that it does not provide enhancement, or betterment of the situation beyond that. The beach nourishment design for this Project is a balance and consideration of a wider set of constraints and specific objectives. It is also primarily driven to minimise recreational effects (until, as I discuss in my evidence above, the effects of climate change will inundate the beaches). I note that the proposed conditions (**EM.15** and **EM.17**) explicitly include a review and interpretation (after two years) by a coastal professional to determine whether design conditions in the BNP have been met and if they have not, whether top-up nourishment or beach maintenance should be instigated.

120. I agree that it would be beneficial for HCC's consider how the coastal monitoring for the Project could be taken up as part of a longer term monitoring plan and linked to the longer-term adaptive pathways that HCC are yet to develop (as per MfE(2017)). HCC's long-term strategy, of which the Project effectively forms the one of the first steps, is expected to require long-term monitoring of coastal changes and coastal hazards. As such, I consider that the monitoring for this Project should be recognised as an

opportunity to support (by way of a ‘first step’) monitoring for a long-term DAPP facilitated plan for HCC and the Eastern Bay.

Geoffery Rashbrooke (179)

121. Mr Rashbrooke provides some observations of the physical form of the beaches and raises concerns that the proposed beach nourishment will need to be continuous, citing his observations of what occurs at Oriental Bay and that the proposed nourishment will sit on top of the sand, having an impact on enjoyment of water activities. I defer to **Mr Reinen-Hamill’s** evidence on the links to Oriental Bay.

122. Mr Rashbrooke also provides some recommendations for the coastal seawall designs. He suggests that enhanced seawalls are needed but thinks proposed ones will not prevent road closure during adverse weather and high tide. I agree with Mr Rashbrooke that they will not prevent all closures at high tides with adverse winds/waves. However, the agreed design is the result of a multi-disciplinary decision-making criteria, with specific consideration of the elevation of the crest being addressed in the *Alternatives Assessment*. For example, at their simplest design components, preventing overtopping events would require a structure which is a) either very wide so waves break much further offshore - but would require considerable encroachment into the ecologically valuable intertidal and subtidal habitats, or b) a structure with a much higher crest - but this would dramatically reduce the amenity of the Eastern Bays. There is also the unavoidable effect of winds which blow any wave spray onto the roadway and cannot be realistically designed out whilst maintaining visual connection to the coast

123. Mr Rashbrooke also suggests a wooden boardwalk would be an appropriate measure. I have commented on this design approach in my response to Mrs Hay above.

RESPONSE TO COUNCIL OFFICER’S SECTION 42A REPORT

I have the following comments on the Section 42a report.

Loss of high-tide beach and beach nourishment, pg 61 (12.2.4)

124. The Officer’s report recommends the applicant confirm the total loss of high-tide beach area at Lowry Bay in advance of the hearing. The report provides a table which shows a loss of beach area at high tide of 379 m^2 after construction of the seawall and the nourishment. **Mr Reinen-Hamill** has led the beach nourishment assessment after I completed an initial scoping study. I defer to the evidence of **Mr Reinen-Hamill** to address the values outlined in the table.

125. I agree with Dr Dawe and the Officer's Report that there is no reason that beach nourishment would not be successful and that high-tide beach areas would be maintained with the proposed nourishment.

Effects on coastal processes, pg 64 (12.3)

126. I agree with Dr Dawe that the effects of reclamation will be more pronounced on the small beaches as opposed to the rocky shores and supports proposed mitigation of these effects through beach nourishment at York Bay, Lowry Bay and Point Howard. Dr Dawe recommends some reshaping of existing beach material in some of the smaller pocket beaches and stretches (Mahina Bay and Sunshine Bay) that are not part of the formal beach nourishment mitigation, and suggests that these beaches could also benefit from a little material being added to them to mitigate potential impacts on coastal processes.

127. Dr Dawe considered encroachment at these beaches did not require formal nourishment because the effects were not significant but suggested that a seaward translocation or reshaping of the existing excavated material on these beaches during construction of the seawalls would be appropriate. I agree with Dr Dawe that this process of retaining native beach material, but not construction rubble, would be beneficial to the beaches within these bays. I note that this was suggested for inclusion within the indicative construction methodology, and that this can be managed within the construction methodology through the CEMP process.

Edge effects at seawall transitions and tie-ins (see additional consent conditions recommended) pg 70 (12.3.5)

128. The Officer's report suggests two additional consent conditions as based on the assessment of Dr Dawe (GWRC Appendix G). They are that 1) "*Any erosion, scour or instability of the CMA that is attributable to the structures and works carried out as part of this permit is repaired by the consent holder"* and 2*) "The structural integrity of any structure remains sound in the opinion of a Professional Chartered Engineer"*.

129. Dr Dawe (GWRC Appendix G, conclusion point 2) suggests a condition that enables adaptive management to halt work and to reassess if any effects more than minor. Practically, it is unclear what monitoring for erosion/scour or instability could entail, whether it be reasonably determined to be more than a short-duration construction effect (caused by the temporary formwork, or enclosing bunds around the site), or what repair works would be required.

130. HCC undertake standard asset monitoring whereby engineers periodically check the structural condition of the seawalls, in part to ensure preventative maintenance can be appropriately enacted, and as a precaution because of the key assets they protect within the roadway and the roadway itself. I

support the continuation of this monitoring/maintenance program but do not consider it appropriate as a condition of consent. HCC have a long history of active management of this shoreline as outlined above in the site photographs from HCC's archives which were from seawall condition assessments in January 1991, and it is in their best interests to continue maintenance of their assets.

131. I also consider that the detailed design process, which requires sign off from GWRC, is an opportunity for GWRC to identify and ensure that the designs adequately address the potential for any more than minor effects before construction commences. Certification by an appropriately qualified and experienced person would be part of the detailed design process.

Erosion and design integrity of seawall types pg 71 (12.4)

132. The Officer's Report highlights a number of comments from Dr Dawe and Ms Westlake. In particular, the author considers it appropriate for detailed design to finalise the foundation depths and embedment. I agree with Ms Westlake that, if required, the keying in or embedment of rock revetment to the rocky shore platforms can be confirmed through detailed design and subject to peer review by an appropriately qualified and experienced engineer. However, I note that the revetment body is principally intended as a wave dissipation feature with the self-supporting cantilevered vertical wall behind the revetment the key structural element supporting the Path and road. The wall and revetment will be subject to number of internal reviews and approvals within detailed design process.

Natural character - rock colour discussions and recommendations pgs 74 and 75 (12.5)

133. The Officer's Report considered the feedback of Mr Head about colour of the rock to be used as the revetment material. I have outlined the key points in the selection of rock material earlier in my evidence. Whilst I am sympathetic to the landscape and visual character of the rock colours noted by Mr Head, I do not consider that the input of a landscape architect to final rock selection is necessary as there are a limited number of potential rock sources with limited color palette to select from. Typically, the cost and durability are a key elements in selecting rock material. A local source may be an option for a cheaper source with more natural colours, however there would likely be a compromise to the longevity of the revetment, and increased maintenance costs for HCC.

Effects from sedimentation and other contaminants Pg 81 and 82 (12.6.2)

134. The Officer's Report outlines a concern that the CEMP and construction method, only include minimal details on requirements for the CEMP, and recommends a condition requiring the CEMP include the requirement for the

consent holder to develop management trigger limits and supporting monitoring and reporting actions in consultation with GWRC advisors. I support this inclusion with the CEMP and consider it is addressed within **GC.7** and **GC.8** and hence will be addressed at the appropriate time.

135. The Officer's Report considers additional consent conditions related to the discharge of sediment laden water is to stormwater or the CMA by setting a limit to sediment concentrations of 100 g/m^3 and 2) that the GWRC standard condition requiring for discharge to the CMA is included. I support these inclusions within the CEMP and believe they are addressed within **GC.7** and **GC.8** and hence will be addressed at the appropriate time.

136. Further, I agree that setting an agreed limit on suspended sediment in any discharge to the CMA (or stormwater network) would be a practical option for the CEMP to ensure visually obvious discharges are limited. I note that the beach sites will intermittently experience high sediment concentrations during storms (as waves reworking beach sediments) and during Hutt River flood events as I outlined in the existing environment of the Coastal Processes Assessment report. This is also addressed in the evidence of **Ms McMurtrie**.

Effects on intertidal and subtidal beach ecology during beach nourishment pg 85 (12.7.2)

137. The Officer's Report considers additional consent conditions for the BNP around the machinery to be used and the timing of the nourishment. I support the inclusion of an item within the BNP to restrict the machinery to above the MHWS line. However, I note that the suggested wording implied that all bench material should not extend below the MHWS line and consider that is impractical to <u>keep</u> the redistributed beach material above the MHWS but it would be possible to initially <u>place</u> the excavated beach material above MHWS. After placement, the natural beach processes can move this sediment over time and tides.

138. These items are also addressed in the evidence of **Ms McMurtrie** and **Mr Reinen-Hamill.**

Intertidal ecology; Revetment pg 93 (12.9)

139. The Officer's Report recommends that re-use 'won' rock (during foundation excavations) can be re-used as various ways onsite, including being deposited on rock platforms to be broken/dispersed by waves, or manually placed into voids in the rock revetment as habitat. This material can be stockpiled and then placed following completion of the rock revetment, and should maximise the range of rock sizes. I agree with this and note that the slow weathering will further benefit the small pocket beaches of the Eastern Bays by providing additional weathering material to supplement the beaches.

140. I also agree that this ‘won’ rock should not be used as bulk fill <u>within</u> revetments.

Monitoring period

141. Dr Dawe (GWRC Pgs 5/6 and Appendix G, Conclusion point 1) identifies differences of monitoring period between NIWA and T+T report (5 year and two year respectively) and concludes three years with annual assessments might be reasonable and there should be a baseline survey immediately post nourishment survey. I agree that there should be a baseline survey and consider that this is implicit within assessing the “design conditions at the time of the beach nourishment” (**EM.14**) on which the final BMP nourishment volumes are determined.

Michael James Allis

30 November 2020